Seasonal Outlook for Ross Sea and McMurdo Sound 2018-2019

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INTRODUCTION

The US National Ice Center (USNIC) provides planning and real time operational support for the efforts of the United States Antarctic Program (USAP) through collaboration with NSF and the U.S. Coast Guard (USCG). Specifically, this outlook is provided as environmental awareness to safely plan icebreaker operations in the McMurdo/Ross Sea channel and escort ice-strengthened tanker and an ice-strengthened cargo ships to the pier at McMurdo Station, located at 77°51'S, 166°40'E [4].

In this specific outlook, the term "ice edge" is used to delineate the boundary between areas with greater than or equal to 4/10ths sea ice and areas with less than 4/10ths sea ice.

METHODOLOGY

Climatology: The rates of recession for the Ross Sea ice edge are predominately derived using an analog forecasting technique that relates historical observations of pre-season ice extent and thickness to the predicted severity of austral summer ice conditions. This analog data from climatological conditions is adjusted to reflect the expected impact of current meteorological and oceanographic conditions in the Ross Sea.

Current Conditions: Based on the USNIC ice analysis for 01 November 2018 the position of the northern ice edge was near the climatological max across the majority of the Ross Sea. Average temperatures for this past Antarctic autumn and winter of 2-4^{o}C above normal [2], could translate into thinner ice during the 2017 – 2018 season.

As of 01 November 2018, the Ross Sea is covered with thick first year ice (>47" or >120cm), with a N-S region of old ice in the eastern Ross Sea between 67°S and 75°S and stretching from 176°W to 156°W into the Amundsen Sea (this can be seen as the dark red shape in figure 2 below).

In McMurdo Sound, the fast ice along the coast is in two bands of different ice types as shown below in Figure 1. There are approximately 10 nautical miles of thick first year ice then 6 nautical miles of second year ice totaling 16 nautical miles from the edge to the center of the turning basin. Based on a mid-November sea ice survey by McMurdo Station staff, the second year ice ranges from 90-98" (220-250cm) [1], while the first year ice has thicknesses ranging from 51-73" (130-185cm) [1].

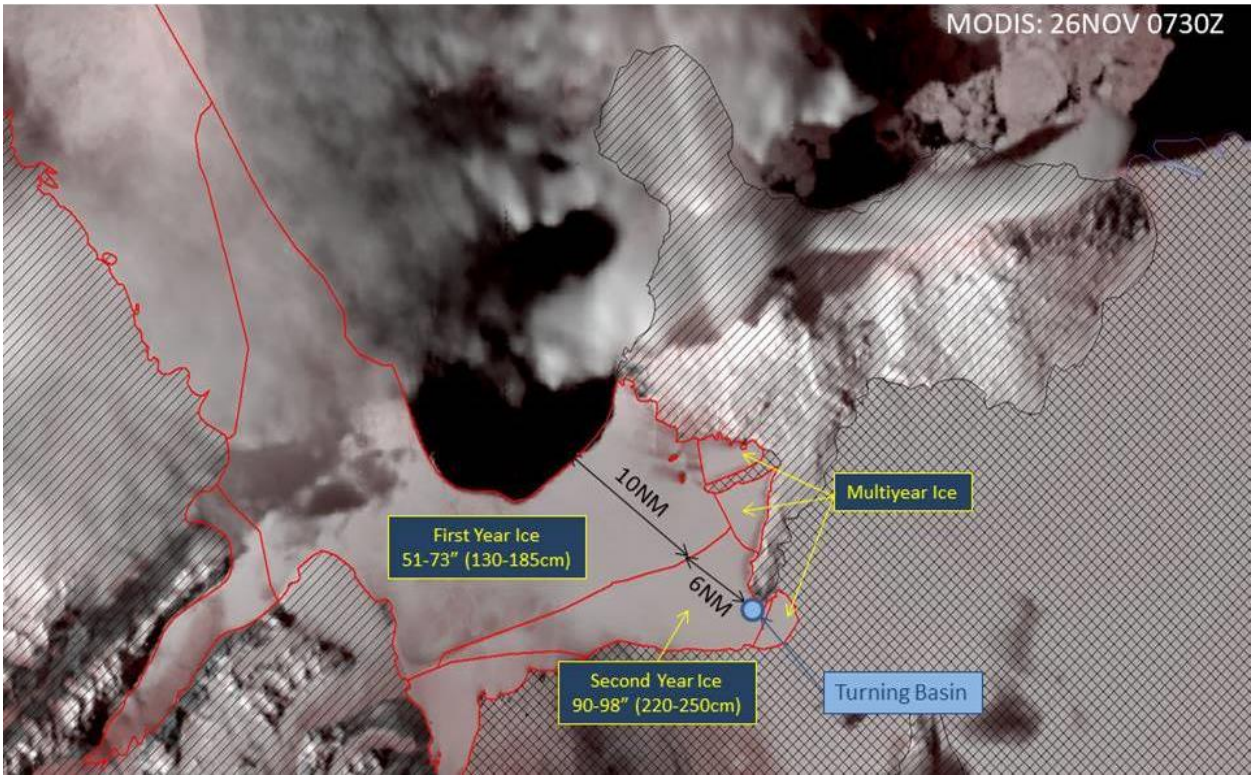

Figure 1. Fast Ice situation in McMurdo Sound as of late November. MODIS Image.

The atmospheric circulation of the southern high latitudes is dominated by a westerly circumpolar vortex that extends from the surface to the stratosphere. The long-term variability in this vortex is called the Antarctic Oscillation (AAO) [5] or Southern Annular Mode (SAM). The AAO has been close to neutral since early October, but has trended positive for the second week of November. If the trend toward a more positive AAO persists, there should be stronger westerly flow and Ekman drift transport of water and ice northward in the Southern Ocean and Ross Sea. The NOAA CPC forecast shows a moderately positive AAO through November. Another effect of the positive AAO is that it may inhibit melt by isolating Antarctica from warmer mid-latitude air.
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/aao/aao.shtml

Additional input considered for this outlook includes:

(a) Surface air temperature
(b) Sea surface temperatures along the ice edge
(c) Fast ice extent in McMurdo Sound
(d) Current location of ice edge compared to previous year for same time frame
(e) Location and concentration of first-year and multi-year ice
(f) Meridional wind anomaly in the Ross Sea
(g) NRL NESM 45 day model sea ice thickness and concentration forecast

OUTLOOK

The Ross Sea in mid-October, revealed similarities to ice conditions found in mid-October 2014. During 2014, the unescorted date was in the first week of February.

Using 2014-2015 as an analog, this year's (2018-2019) outlook is for the open water regions to expand with the typical hourglass pattern with the opening occurring near 175°W.

After accounting for the warmer than average temperatures, the lack of an east-west band of old ice across the Ross Sea, and the potential influence of the AAO, it is projected that vessels in the Ross Sea will require icebreaker escort until approximately 20 Jan 2018. Navigable ice conditions for unescorted vessels (≤4/10) are expected after 20 January 2018.

Complicating factors in this outllook are whether the region of old ice in the eastern Ross Sea will drift westward into the N-S channel of open water. The primary concentration of old ice is quite low (2/10ths) so it could melt just as readily as first year ice. Other complicating factors are in McMurdo Sound where there is 6 nautical miles of second year ice, and whether southerly winds remain too weak to flush the ice away from the area around McMurdo Station as happened last season.

Given these challenging conditions, USNIC will publish bi-weekly updates to this outlook beginning 15 December corresponding to our meltout recession dates shown in Figure 2 below.

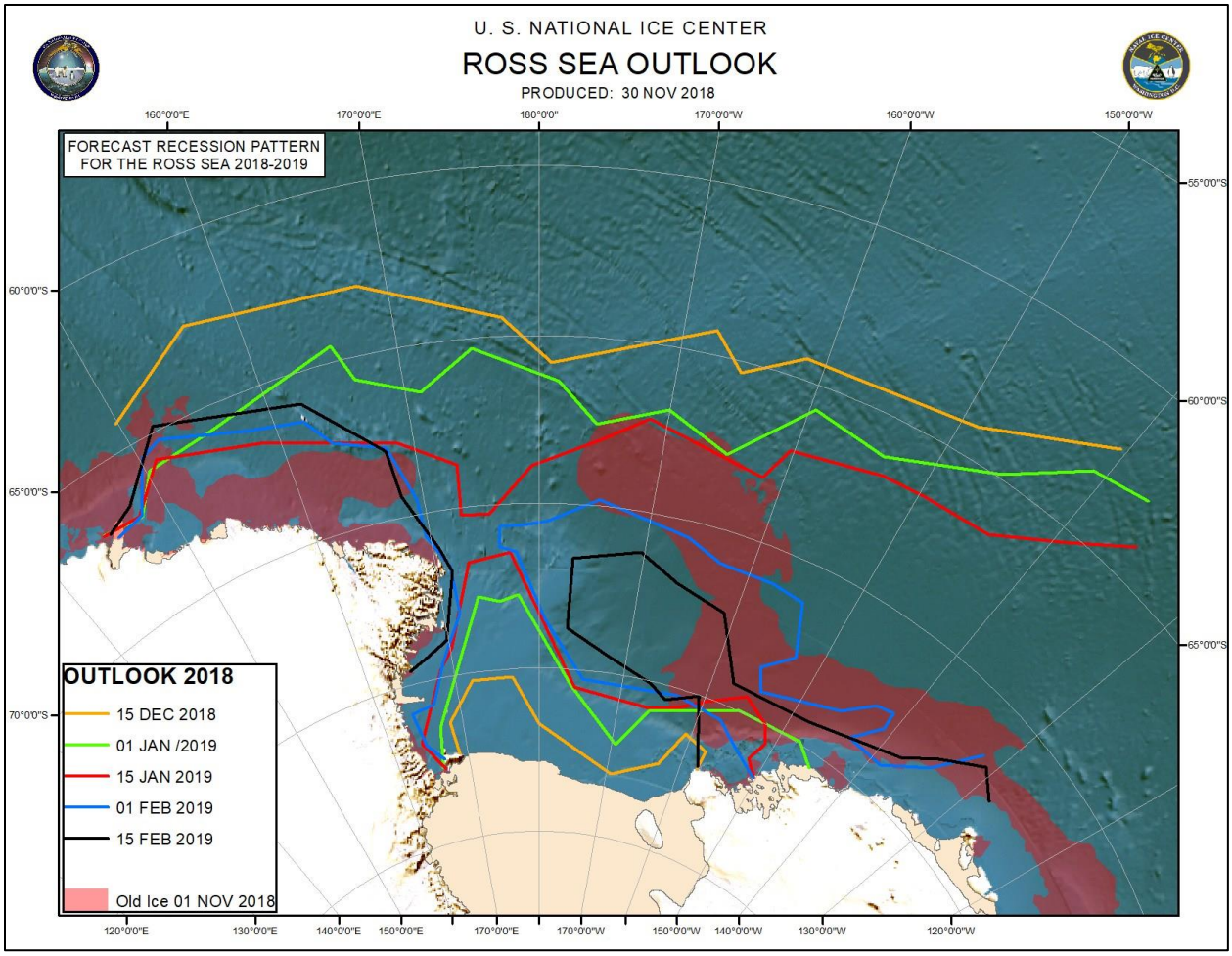

Figure 2. 2018-2019 Ross Sea Ice Edge Recession Outlook (<4/10 ice edge).

As always, there are numerous small icebergs scattered throughout the Ross Sea which can pose a hazard to navigation. Sea ice analyses for the Ross Sea can be obtained via the NIC website at: https://www.natice.noaa.gov/products/weekly_products.html

REFERENCES

[1] Haskell, D. (2018), McMurdo Sound Sea Ice Report November 19, 2018.

[2] Kalnay, E. and Coauthors, (1996), The NCEP/NCAR Reanalysis 40-year Project. Bull. Amer. Meteor. Soc., 77, 437-471.

[3] Metzger, E. J. et al., (2014), Operational Implementation Design for the Earth System Prediction Capability (ESPC): A First Look, Naval Research Laboratory, NRL/MR/7320—14-9498.

[4] National Science Foundation. NSF Request for Information No. DCCA-050044; Time Charter Party Agreement for Ice-Breaking Vessel(s) to Assist Re-supply of McMurdo Station, Antarctica. http://www.nsf.gov/about/contracting/dcca_050044.doc .

[5] Thompson, D. W., and J. M. Wallace (2000), Annular modes in extratropical circulation, Part II: Trends, J. Clim., 13, 1018– 1036.